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The Costs/Benefits of a Common Monetary Policy in France and Germany and Possible Lessons for Monetary Union

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Abstract

In order to study the costs/benefits of a monetary union between Germany and France, we attempt to go beyond a mere focus on asymmetries and examine what each country would have lost or gained had there been a common monetary policy. We try to identify the macro effects of such a change within a structural VAR model, which is first estimated by employing mixed long-run and short-run identification schemes and subsequently simulated under the restrictions of a common monetary policy. Our analysis centers on the effect of identical monetary policy on movements in output, inflation and the current account. We also study the effects on interest rate differentials in order to draw possible inferences about monetary integration. Based on the usual interpretations of national preferences in both countries, the results imply that, if anything, Germany would lose from any French participation in the setting of domestic monetary policy. By contrast, however, France would clearly gain from corresponding German participation in French decision-making.

JEL classification: F02, F15, F40

Keywords: optimum currency areas, structural vector autoregression, shocks, costs/benefits, monetary union

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1. Introduction

Would European countries gain from moving to a monetary union? Efforts to answer this question have mostly centred on the shocks affecting the member countries. Except for attempts to apply large-scale macroeconomic models, this research has primarily tried to distinguish between common and idiosyncratic or symmetric and asymmetric shocks. The general idea has been that only the idiosyncratic or asymmetric shocks imply any costs of monetary union. Thus, Cohen and Wyplosz (1989) and Weber (1990) divided up movements in key macroeconomic variables in the EC into cross-country sums and differences, and used the differences to reflect the effects of the idiosyncratic shocks. Related work at the industry level has been done by the Commission of the European Economies (1990), Bini-Smaghi and Vori (1993), and Helg, Manasse, Monacelli and Rovelli (1994), among others. Recently, Bayoumi and Eichengreen (1992) took a different approach: they used the structural vector autoregression (SVAR) model that was pioneered by Blanchard and Quah (1989) to derive the demand and supply shock components of output and prices in each country, and then they assessed the importance of asymmetries by looking at the association of these two separate structural shocks between the countries.

These efforts all leave open the fundamental question what the countries can do about their idiosyncratic shocks right now through independent monetary policy. If monetary policy feeds directly into money wages and prices, then this policy cannot affect real variables, and no matter how large idiosyncratic shocks may be, sacrificing monetary independence cannot cost much in terms of stabilization. The theory of the optimum currency area has always considered the ability to stabilize the economy through exchange rate manipulation to depend on the degree of price flexibility. As early as 1963, McKinnnon underlined the possible futility of attempts to use monetary policy to smooth the responses to any kinds of shocks in the case of very small and very open economies.

In order to address the previous issue, we examine how a country would have fared if its monetary policy had been dictated partly or wholly by another country's preferences and experience. First we analyze the actual history of France and Germany with the SVAR approach. Then we compare the events in both countries with a hypothetical scenario in which one country sets joint monetary policy for the two of them, or they both choose the policy together. The pertinence of the exercise would seem clear. If differences between shocks and responses to shocks in France and Germany imply high welfare costs of pursuing an identical monetary policy, this should show up when we allow either country to dictate monetary policy in the other.

The meaning of an identical monetary policy in both countries must be precisely defined. By such a policy, we shall mean identical money supply shocks and not necessarily identical interest rates. Of course, identical interest rates would exist in a monetary union. But had the French authorities simply followed German interest rates in the seventies and eighties, their action would have meant lower interest rates at home and fundamentally easier monetary policy. Moreover, this action might have generated instability of the franc/mark exchange rate and thereby violated another implication of monetary integration. In a monetary union, market arbitrage assures a single nominal interest rate and there is no internal nominal exchange rate to fix. Therefore, the monetary authorities can pursue any policy they like without any concern about internal differences in nominal interest rates on homogenous debt. That is why the most relevant exercise in dealing with historical series, in our view, is one where the authorities of France and Germany simply pursue an identical monetary policy without any regard for their *relative* interest rates. We shall interpret such identical policy in our counterfactual simulations of the past to mean identical monetary surprises in both countries.

Whether uniform monetary policies would also have promoted convergence of nominal interest rates is a separate issue. This other issue concerns the important question whether a common monetary policy would have tended toward monetary integration. The answer, we shall find, is positive, but the strength of the tendency toward monetary integration depends largely on the common policy which is pursued, or, in our particular examples, whether France or Germany was the one to decide joint policy.

The paper moves along as follows. Section 2 provides a short sketch of our model -- an open economy version of IS-LM with a Phillips curve. In section 3 we lay out our empirical methodology. The section proceeds, step by step, to explain the general identification problem at hand, our particular choice of specification of a SVAR, and our identifying restrictions. Because of our research strategy, we need to identify more shocks than Bayoumi and Eichengreen did. While two shocks sufficed them, we shall require six, including a shock in either country stemming from the other's monetary policy. Our econometric work actually has much more in common with Galí's (1992) extension of Blanchard and Quah than Bayoumi and Eichengreen's. Like Galí, we use a combination of long-run and short-run restrictions, and again like him, we consider the long-run ones to be based on neutrality and the dominance of supply-side effects on potential output, while the short-run ones depend on the need for a lapse of at least one quarter before monetary-policy surprises bear any real effects. However, we also deviate significantly from Galí by introducing open-economy influences.

Section 4 prepares the way for the main part of the analysis by discussing the results for Germany and France over the study period and relating them to our theoretical model as well as previous work. The section shows that our estimates agree largely with those of Galí for the United States. Important differences arise, nevertheless, because of the major role of two of the open-economy variables in our study -- the real exchange rate and the relative demand for domestic as opposed to foreign goods.

Section 4 has the additional, important purpose of exploring Bayoumi and Eichengreen's criterion of asymmetry between countries. We show that by focusing upon cross-country correlations between structural shocks, their criterion tends to exaggerate the impression of differences between countries. By the very nature of the SVAR method of identifying shocks, the greater the number of structural shocks, the less likely any major cross-country correlation between them. In our work with six shocks, the six-by-six matrix of correlations of shocks between Germany and France contains only low figures.[1] Yet there exists a substantial resemblance between the French and the German macroeconomic experiences of the eighties. This resemblance can be made somewhat more apparent in the analysis by examining the cross-country correlations between the components of output, inflation, and the current account -- or the primary macroeconomic variables -- that are attributable to the separate shocks rather than the correlations between the shocks themselves. The matrices of these cross-country correlations of the shock components of macroeconomic variables typically display larger numbers.[2] Thereby the evidence of some degree of common experience and interdependence between the two countries comes back into view.

Section 5 contains our central results about monetary union. The estimates agree with the standard opinion that French decision-making would have created more unstable monetary policy in Germany during the study period, while German decision-making would have caused tighter monetary policy in France. The estimates go on to say that with France at the monetary controls, Germany would have experienced higher current account surpluses, while if Germany had been at the helm, France would have undergone wider changes: less inflation,

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[1] Compare Erkel-Rousse and Mélitz (1995), who get the same result.

[2] These correlations, it should be noted as well, link up the decompositions of Cohen-Wyplosz and Weber, concerning the macroeconomic variables themselves, with those of Bayoumi and Eichengreen, which relate to the structural shocks.

greater current account deficits and higher output.[3] Given the relative magnitudes of these changes, it can be inferred that while Germany would have disliked the French policy choices, France would even have preferred the German ones. Such conclusions depend mostly on conventional views about social preferences in both countries. Thus, from the standpoint of the quality of policy decisions (based on national tastes), we conclude that France has nothing to fear from monetary union with Germany while the opposite is not evident. On these grounds, a Franco-German monetary union might require political compensations to Germany by France, as is often asserted. Finally, our results indicate that the pursuit of a joint monetary policy would have promoted monetary integration -- or at least would have done so in the event of German dominance over policy.

The conclusion briefly summarizes some of the main points.

2. A Simple Open Economy Model

At the core of the simple macro model in this paper is an open economy version of IS-LM augmented by a Phillips curve. Two equilibrium conditions mainly characterize the model: one for the aggregate domestic goods market ($y_t^s = y_t^d$), and another for external equilibrium ($\chi_t = 0$). The first depends on price adjustment, the second on adjustment in the real exchange rate. The dynamics of the model are governed by the slow adjustment of prices and real exchange rates over time and they embody certain long-run neutrality restrictions. Furthermore, movements in the main macro variables stem predominantly from the propagation of six types of exogenous disturbances: shocks to domestic aggregate supply (η_t^s), domestic demand (η_t^d), relative demand for home goods or net exports ($\eta_t^{d^*}$), domestic and foreign monetary policy (η_t^m and $\eta_t^{m^*}$), and relative velocity of money at home and abroad ($\eta_t^{v^*}$). The shocks $\eta_t^{m^*}$ originate abroad and the other two open-economy shocks, $\eta_t^{d^*}$ and $\eta_t^{v^*}$, may also but need not do so.

Our simple textbook model can best be illustrated by the following set of equations, where all variables except interest rates are measured in logarithms:

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[3] Of course, all of these results suppose that a change in monetary policy would have left the response parameters the same. They are therefore subject to the Lucas Critique. In common with many others we must assume that any changes in parameters stemming from a shift in policy would have been gradual enough not upset our basic conclusions over a significant horizon.

(Phillips curve) $$\Delta p_t = \pi_{t-1} + \delta(y_t - \eta_t^s) \quad (1)$$

(Aggregate output, IS) $$y_t = \alpha_0 - \alpha_1(i_t - \Delta p_{t+1}^e) + \alpha_2\beta_1(e_t + p_t^* - p_t) + \alpha_2\eta_t^{d*} + \eta_t^d + \eta_t^s \quad (2)$$

(Current account) $$\chi_t = \beta_1(e_t + p_t^* - p_t) + \eta_t^{d*} \quad (3)$$

(Real effective exchange rate) $$e_t + p_t^* - p_t = (e_{t-1} + p_{t-1}^* - p_{t-1}) - \gamma_1\chi_t + \eta_t^{v*} \quad (4)$$

(Interest rate and monetary policy) $$i_t = \zeta_{t0} + \zeta_1 y_t + \zeta_2 (p_t - \eta_t^m) \quad (5)$$

(Monetary policy differences) $$i_t - i_t^* = \xi_{t0} + \xi_1 y_t + \xi_2 (p_t - \eta_t^m) + \eta_t^{m*} \quad (6)$$

Equation (1) is an open-economy Phillips curve with a sluggish adjustment of output prices (Δp_t) to excess demand ($y_t - \eta_t^s$). Equation (2) defines domestic output (y_t) as a sum of aggregate demand for domestic goods and supply shocks ($y_t = y_t^d + \eta_t^s$).[4] Thus, like Galí, we assume that supply as well as demand shocks affect *current* output. Aggregate demand for domestic output is decreasing in the domestic real interest rate ($i_t - \Delta p_{t+1}^e$), increasing in the real exchange rate ($e_t + p_t^* - p_t$), and subject to domestic demand (η_t^d) and relative demand (η_t^{d*}) shocks. We measure the current account (χ_t) as the ratio of net exports (or exports minus imports of goods and services) to nominal gross domestic product. The distinction between the domestic demand shocks η_t^d and the relative foreign demand shocks η_t^{d*} follows accordingly. That is, the former shocks affect aggregate demand while leaving χ_t unchanged, whereas the latter ones affect aggregate demand via χ_t. Imbalances in the current account drive the real exchange rate ($e_t + p_t^* - p_t$) in the long-run. However, short-run deviations from current account balance -- and therefore misalignment -- can come about because of shocks to the excess demand for foreign money relative to domestic money, which we denote as relative velocity shocks (η_t^{v*}).

The money shocks η_t^m in equation (5) reflect influences of domestic monetary policy on the interest rate. The y_t and p_t terms in the equation, in turn, concern the impact of the demand for money. Effectively, therefore, the monetary authorities do not offset the other forces impinging on the interest rate -- or at least do not do so perfectly. The next equation, (6), introduces a bilateral relation with the second country considered as a potential participant in a

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[4] α_0 in equation (3) should appropriately be defined so that in the steady state, $y = \eta^s$. Consequently, η^s must represent the process driving natural output.

monetary union. The term for the foreign money supply shock $\eta_t^{m^*}$ reflects that part of the *differential* between monetary policy at home and in the other country which is attributable entirely to the foreigner's interest rate policy. It should be carefully noted that i_t^* and $\eta_t^{m^*}$ in equation (6) are quite different from the other open-economy variables (χ_t, $e_t + p_t^* - p_t$, $\eta_t^{d^*}$ and $\eta_t^{v^*}$) in that they refer to a specific foreign country (France or Germany, as the case may be) and not to a relationship between the domestic country and the rest of the world. The equation obviously agrees with open interest rate parity given appropriate expectations.

The stylized predictions of this simple textbook model for the small open economy can be summarized as follows:

(a) Domestic and relative demand shocks have short-run effects (which may disappear in the long-run) on GDP and other real variables, such as the current account, real interest rates and real exchange rates as a result of sluggish adjustment of prices;

(b) Domestic monetary shocks are transmitted to the real sector only through changes in real interest rates;

(c) Relative velocity shocks are transmitted to the real sector only through changes in real (effective) exchange rates;

(d) Real GDP moves in the same direction as prices in response to domestic and relative demand, domestic and foreign money supply, and relative velocity shocks, but the two move in opposite directions in response to aggregate supply shocks.

3. The Structural VAR Model

3.1 General Approach

Since we adopt an extended version of Galí's (1992) structural VAR approach in identifying our open economy version of an IS-LM model for France and Germany, let us also follow his exposition of the structural VAR methodology. This methodology assumes that $\mathbf{x}=[x_1,x_2,x_3,...,x_k]$ is a covariance stationary vector process, where $\mathbf{x}$ refers to a matrix of sets of observations. Each of the k elements in $\mathbf{x}$ has zero mean, or rather, has been differenced, demeaned or detrended prior to the estimation. Every element in $\mathbf{x}$ can also be expressed as a linear combination of current and past structural shocks $\varepsilon=[\varepsilon_1, \varepsilon_2, \varepsilon_3,..., \varepsilon_k]$.

Formally, **x** has a moving average representation:

$$\mathbf{x}=C(L)\varepsilon. \tag{7}$$

The reduced form Wold moving average representation is given by:

$$\mathbf{x}=E(L)\nu, \tag{8}$$

where $E(L)=[E_{ij}(L)]$, $E(0)=I$, and $E(L)$ is invertible. After inversion of $E(L)$, the reduced form autoregressive representation in terms of the innovations ν becomes:

$$B(L)\mathbf{x}=\nu, \tag{9}$$

with $B(L)=[B_{ij}(L)]$, $B(L)=E(L)^{-1}$, and $B(0)=I$, while the autoregressive representation in terms of the structural shocks ε follows as:

$$A(L)\mathbf{x}=\varepsilon, \tag{10}$$

with $A(L)=[A_{ij}(L)]$. The reduced form innovations ν are assumed to be a linear combination of the structural disturbances ε

$$\nu=S\varepsilon, \tag{11}$$

with and $A(0)=S^{-1}$. Given equations (7) and (8), this implies

$$C(L)=E(L)S, \tag{12}$$

Since OLS estimation of equation (9) yields estimates of $B(L)$ and hence estimates of its inverse, $E(L)=B(L)^{-1}$, the matrix $C(L)$ can be uniquely identified once enough restrictions are introduced to just-identify the matrix S.

How can such restrictions be obtained? As a start, it is convenient to assume that the structural shocks ε are mutually orthogonal. Together with a helpful normalization condition,[5] this assumption implies that $E(\varepsilon\varepsilon')=I$. Using this normalizing condition along with equation (11) yields:

$$SS'=\Omega, \tag{13}$$

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[5] The relevant normalization ensures that the vector of shocks ε is measured in terms of one standard deviation of the corresponding variable in the vector **x**.

After having found the OLS estimate of the variance-covariance matrix Ω of the reduced-form errors ν, this last factorization imposes $k*(k+1)/2$ non-linear restrictions on the elements in S (that is, 21 resrictions for k=6). There then remains the issue of choosing restrictions for the other $k*(k-1)/2$ elements of S, to which we shall return following the discussion of our VAR specification.

3.2 Specification

In order to specify a structural VAR model conforming to our theoretical macro model, we began by performing the appropriate unit root and cointegration tests on the series for y_t, p_t, i_t, $i_t-\Delta p_t$, $i_t-i_t^*$, χ_t, and $e_t+p_t^*-p_t$. These tests are documented in detail in the appendix of the paper. Wherever these tests did not provide clear-cut results, we stuck as closely as possible to Galí's choices in order to ease comparison. We also decided to estimate an identical model for both countries. Thus, we had to compromise on the specification in those cases where the time series properties of the data differed between Germany and France. This turned out to be a problem only with regard to inflation. Like Gali, we faced a choice between treating inflation as I(0) or I(1). The evidence points strongly to I(0) in the case of Germany, based on the Phillips-Perron test. Thus, we treated inflation as an I(0) process in both countries, in keeping with Galí, even though the issue is somewhat ambiguous for France.[6] For this reason we will report on our main policy conclusions for France based on the I(1) inflation specification. Thereby we will demonstrate the robustness of our results.

We formulated our structural VAR model for the covariance stationary vector process $\mathbf{x}=[\Delta y_t, i_t-\Delta p_t, \Delta p_t, \Delta(i_t-i_t^*), \Delta\chi_t, \Delta(e_t+p_t^*-p_t)]$, where Δy_t is the first difference in the logarithm of GDP, i_t is the level of the nominal 3-month interest rate, Δp_t is the first difference in the logarithm of consumer prices (and therefore $i_t-\Delta p_t$ is the real interest rate), $i_t-i_t^*$ is the 3-month interest rate differential, $\Delta\chi_t$ is the first difference of the current account balance to GDP ratio, and $\Delta(e_t+p_t^*-p_t)$ is the first difference in the real effective exchange rate (REER) based on normalized relative unit labor costs.[7]

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[6] As a result, we rewrote equation (1) accordingly with a constant instead of a lagged-inflation term on the right.

[7] All of our data are taken from the IMF *International Financial Statistics*, various issues, except for money market interest rates, which come from the OECD, *Main Economic Indicators*, various issues.

Applying the structural VAR approach meant supposing that the vector process **x** is driven by a vector of six structural disturbances $\varepsilon=[\varepsilon_t^s,\varepsilon_t^m,\varepsilon_t^d,\varepsilon_t^{m^*},\varepsilon_t^{d^*},\varepsilon_t^{v^*}]$, consisting of aggregate supply shocks (ε_t^s), domestic and relative demand shocks (ε_t^d and $\varepsilon_t^{d^*}$), domestic and foreign monetary policy shocks (ε_t^m and $\varepsilon_t^{m^*}$) and relative velocity shocks ($\varepsilon_t^{v^*}$). The vector of structural shocks ε is then the empirical counterpart to the vector of structural disturbances η in our open economy macro model.

3.3. Identifying Restrictions

To achieve identification of the structural shocks $\varepsilon=[\varepsilon_t^s,\varepsilon_t^m,\varepsilon_t^d,\varepsilon_t^{m^*},\varepsilon_t^{d^*},\varepsilon_t^{v^*}]$ on the basis of the estimates of B(L) and the reduced form residuals ν and their variance-covariance matrix Ω, the matrix S has to be determined by a non-linear optimization procedure. Just-identification requires the imposition of 36 identifying restrictions. We made the following choices:

(a) 21 non-linear restrictions on the elements in S come from the usual orthogonality condition $SS'=\Omega$ (as mentioned before);

(b) 5 additional restrictions result from the identification of aggregate supply shocks in the tradition of Blanchard and Quah (1989), or by imposing long-run output neutrality of the other five shocks:

$$E_{11}(1)S_{12}+E_{12}(1)S_{22}+E_{13}(1)S_{32}+E_{14}(1)S_{42}+E_{15}(1)S_{52}+E_{16}(1)S_{62}=0,$$

$$E_{11}(1)S_{13}+E_{12}(1)S_{23}+E_{13}(1)S_{33}+E_{14}(1)S_{43}+E_{15}(1)S_{53}+E_{16}(1)S_{63}=0,$$

$$E_{11}(1)S_{14}+E_{12}(1)S_{24}+E_{13}(1)S_{34}+E_{14}(1)S_{44}+E_{15}(1)S_{54}+E_{16}(1)S_{64}=0,$$

$$E_{11}(1)S_{15}+E_{12}(1)S_{25}+E_{13}(1)S_{35}+E_{14}(1)S_{45}+E_{15}(1)S_{55}+E_{16}(1)S_{65}=0,$$

$$E_{11}(1)S_{16}+E_{12}(1)S_{26}+E_{13}(1)S_{36}+E_{14}(1)S_{46}+E_{15}(1)S_{56}+E_{16}(1)S_{66}=0;$$

(c) domestic demand, relative demand, domestic and foreign money supply shocks are assumed to have no long-run effects on the current account (4 restrictions)

$$E_{51}(1)S_{12}+E_{52}(1)S_{22}+E_{53}(1)S_{32}+E_{54}(1)S_{42}+E_{55}(1)S_{52}+E_{56}(1)S_{62}=0,$$

$$E_{51}(1)S_{13}+E_{52}(1)S_{23}+E_{53}(1)S_{33}+E_{54}(1)S_{43}+E_{55}(1)S_{53}+E_{56}(1)S_{63}=0,$$

$$E_{51}(1)S_{14}+E_{52}(1)S_{24}+E_{53}(1)S_{34}+E_{54}(1)S_{44}+E_{55}(1)S_{54}+E_{56}(1)S_{64}=0,$$

$$E_{51}(1)S_{16}+E_{52}(1)S_{26}+E_{53}(1)S_{36}+E_{54}(1)S_{46}+E_{55}(1)S_{56}+E_{56}(1)S_{66}=0;$$

(d) relative velocity shocks, in turn, have no long-run effects on the real effective exchange rate (1 restriction)

$$E_{61}(1)S_{16}+E_{62}(1)S_{26}+E_{63}(1)S_{36}+E_{64}(1)S_{46}+E_{65}(1)S_{56}+E_{66}(1)S_{66}=0;$$

(e) foreign money supply shocks bear no long-run effects on the real interest rate (1 restriction)

$$E_{21}(1)S_{14}+E_{22}(1)S_{24}+E_{23}(1)S_{34}+E_{24}(1)S_{44}+E_{25}(1)S_{54}+E_{26}(1)S_{64}=0;$$

(f) finally, domestic and foreign money supply shocks have no instantaneous effects on output and the current account (4 restrictions)

$$S_{12}=0,\ S_{14}=0,\ S_{52}=0,\ S_{54}=0.$$

These 36 restrictions uniquely determine the matrix S, as is essential in order to decompose the estimated VAR residuals into their orthogonal structural shock components. It may be readily seen that our theoretical restrictions represent a combination of long-run neutrality conditions (extended so as to cover the real exchange rate and the current account) and the hypothesis of the absence of short-run monetary effects on real performance.

4. Empirical Results for Germany and France

4.1 The data

In the econometric work, we limited ourselves to seasonally adjusted quarterly data beginning in 1975.3 and ending in 1990.4. Our starting date stems from the lack of ready availability of earlier series for the real effective exchange rate, while our closing date results from the decision (for the time being) not to extend the work after German unification. Because of our use of four one-quarter lags in estimating the VARs, the estimates cover only the years 1977 through 1990, or 56 observations.

Before reporting our estimates, a brief glance at the data is in order. Figure 1 presents the time paths of the key macroeconomic variables under study in Germany and France. The top two panels of the figure show that output moved quite similarly in Germany and France except in the years 1981-85 and following German unification in 1990. For much of the EMS period, a fairly close comovement can be observed. Short term nominal interest rates and inflation

rates converged considerably from 1979 up to 1991, at which time the convergence became almost complete. Nominal interest rates and inflation rates in both countries also moved closely together, thereby implying similar comovement in real interest rates. It follows that nominal and real interest rates are not likely candidates for explaining much of the discrepancies in the movements of output growth between the countries. Real effective exchange rates and current account balances would be far better choices, since these two variables behaved quite differently in the two countries. French and German real effective exchange rates moved largely in opposite directions after 1981. Correspondingly, German and French current account balances also started moving in totally distinct ways at that point. We thus regard real effective exchange rates and current accounts as potentially vital in explaining the differences in real performance between the two countries.

4.2 Impulse Responses

Figure 2 displays the impulse responses of output, inflation, the current account, and nominal interest rates differentials to various one-standard deviation shocks for Germany and France. Both in qualitative and quantitative terms, these results closely resemble those of Galí (1992) for the United States. With regards to Germany and France, the contemporary impact of a positive supply shock is a 0.25 percentage-point increase of GDP. The GDP response in Germany reaches a peak of 0.75 percentage points about 12 quarters after the shock and then retreats to a lower level, while in France the supply-shock response simply builds up continuously but stays below the German values. The supply shocks are also deflationary in both countries. In the case of all of the other five shocks, we find positive medium-run effects of varying profiles on output and inflation in both countries. It is of interest that in addition to supply shocks only aggregate demand shocks and relative demand shocks turn out to have a significant short-run to medium-run output-effects in Germany, while apart from supply shocks relative velocity shocks are those which matter primarily in France.[8]

Two additional differences between France and Germany should be singled out. First, domestic and foreign money supply shocks yield significant short-run to medium-run effects on the current account in France but not in Germany. Second, money supply shocks exert no significant impact on inflation at any frequency in Germany, whereas in France these shocks bear significant medium-

[8] Standard error bands for the impulse response functions were derived by means of a Monte Carlo simulation based on normal random drawings from the distribution of the reduced-form VAR. For technical details and a summary of the results, the appendix should be consulted.

run inflation effects. Finally, note that foreign monetary shocks have rather weak effects in both countries.[9]

Figure 2 displays both the mean impulse responses and the correlations between the German and French impulse response to the each type of shock. Output and inflation respond in a very similar fashion to supply, demand and relative demand shocks, as witnessed by the high correlations, and output and inflation also respond in a highly synchronised manner to these shocks. But the response to domestic and foreign money suppy shocks differ widely between the two countries. Most importantly, domestic monetary shocks have a vastly greater medium-run impact on output and inflation inb France than Germany. As a result, it is possible that a change in monetary policy would have only a small impact in Germany but a large one in France.

4.3 Historical Decompositions into Shock Components

Figure 3 displays the decomposition of output, inflation and the current account into various orthogonal shock components during the study period We do not report similar decompositions for the other endogenous variables because the rest do not play a role in our policy analysis. The graphs highlight the importance of supply shocks in driving output. After the second round of oil price shocks, supply disturbances significantly reduced growth in Germany, though less so in France. These shocks also reduced inflation more in France than Germany after 1987. Another finding of Figure 3 is the fairly similar pattern of influence of several of the shocks -- the domestic demand, foreign money supply and relative velocity shocks -- on output, inflation and the current account in both countries. Thus, the marked difference in current account developments in the two countries that we saw earlier cannot be explained by these shocks. Money supply, relative demand and relative velocity shocks are the ones which contribute most to the differences in current account performance.

But the most important aspect of Figure 3 concerns the contributions of money supply shocks. Owing to steady and predictable monetary policy (as witnessed by small ε_t^m values), money supply shocks explain virtually none of the history of output, inflation and the current account in Germany, whereas in France these shocks contribute heavily to the evolution of all three macroeconomic

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[9] Both in France and Germany none of the six shocks has any long run effects on the real interest rate, which implies offsetting changes in nominal interest rates and inflation. Weber (1995) also found that French and German data were consistent with the long run validity of the Fisher effect of inflation on interest rates. But in the present paper the Fisher effect arises without being imposed as a long-run restriction.

variables throughout the sample. Once again, we see the greater potential for the impact of a change in monetary policy in France than Germany over the test period.

4.4 Variance Decomposition

Table 1 displays the variance decompositions of output, inflation and the current account into their shock components over selected horizons, going from one to forty quarters. The results conform to our earlier discussion. In Germany, supply shocks account for virtually all the variability of output in the long-run; but at business cycle frequencies (say, below ten quarters) domestic demand and relative velocity shocks play the dominant role in output fluctuations. In the French case, where things are otherwise substantially the same, demand and relative velocity shocks dominate supply shocks over a much longer time horizon.

These results deviate from those of either Blanchard and Quah (1989) or Galí (1992) for the United States. Blanchard and Quah attribute virtually all short-term output variability (98% at a four-quarter horizon) to demand shocks, while Galí finds that supply shocks dominate over all horizons. In our study, however, relative velocity shocks and domestic demand shocks play a major role in explaining output variability in both countries over considerable time horizons -- even as compared with supply shocks. This last finding, of course, strongly supports our prior beliefs about the importance of open economy variables in explaining business cycle fluctuations in Europe. In addition, the variability of inflation in Germany and France owes as much, if not more, to relative velocity shocks as it does to supply shocks, especially over the short horizon. Finally, relative demand and relative velocity shocks carry a lot of weight in the evolution of the current account in both countries.

4.5 Cross-Country Associations

In the light of the literature on monetary union, the asymmetry in the business cycle history of the two countries demands particular consideration. Table 2 shows what happens if we measure this asymmetry based on Bayoumi and Eichengreen's criterion, which concerns the correlations between the structural shocks hitting the two economies. As can be seen, most of the numbers in the relevant 6x6 matrix of correlations are relatively moderate. The largest absolute one along the diagonal, 0.32, concerns the association between French and German supply shocks. With regard to the off-diagonal terms, the largest are around 0.4. It is also important to point out the 0.36 correlation between money-supply shocks in France and the foreign money supply shocks originating in Germany. But on the whole the table gives rise to the impression of considerable

asymmetry between Germany and France. However, this impression is highly conditioned by Bayoumi and Eichengreen's chosen criterion. Once we identify as many as six different shocks rather than only two, while imposing a zero covariance between the shocks within each country (by construction), then low contemporaneous correlations between the countries become highly probable. Erkel-Rousse and Mélitz (1995) obtain the same result in a similar identification of five structural shocks in six different countries. Yet the evidence of Figures 1 speaks clearly of important common features in the French and German experiences.

One way to show some of the associations between the German and French histories in our study is to look at the correlations between the separate shock-driven components of the key macroeconomic variables -- output, inflation and current account -- in both countries. These results are shown in Table 3. Now we find substantially larger numbers than the ones regarding the correlations between the shocks themselves. For example, the two relative demand shocks bear highly correlated effects on all three variables -- positive ones in the case of the two outputs and inflations and negative ones in the case of the two current accounts. Relative velocity shocks apparently cause output and the current account to move sharply in opposite directions in Germany and France. Finally, the supply-shock-driven components of German and French output appear to be highly positively correlated, having a coefficient of 0.60 (as opposed to one of only 0.32 for the correlation between the shocks themselves). This higher similarity of movements of the supply shock components of output is the direct consequence of the very similar impulse responses of French and German output to supply shocks. These were shown above to have a correlation coefficient of 0.98. Thus, the prominent associations between the macroeconomic performances of the two countries, which get lost when we only look at the cross-country correlations between the structural shocks, come back clearly into view once we add the shock responses of the two economies and look at the decompositions of macroeconomic variables into their shock components.

5. A Common Monetary Policy

Like others before us, we are essentially interested in comparing shocks and responses to shocks between countries in order to draw implications about the costs or benefits of monetary union. But for reasons given earlier, we propose doing so by focusing on the impact of a common monetary policy. One feature of a monetary union is a common monetary policy, and the experience of such a policy in countries with separate monies, we hope, will carry lessons about the working of the policy under a single money.

A uniform monetary policy will eliminate the shock $\varepsilon_t^{m^*}$, relating to differences in monetary policy that are attributable to the opposite country. With a common monetary policy, the ε_t^m shocks in both countries also become the same. Of course, with a common policy, not only these shocks, but also the predictable element of monetary policy would become identical as well in both countries. However, we cannot handle this aspect. As mentioned before (see note 3), in an SVAR analysis we must assume the parametric structure to stay the same. Therefore, the focus necessarily turns on the impact of monetary surprises within the context of a set parametric structure. We will investigate three cases of common monetary policies in this very important, if limited, sense: (1) German dominance; (2) French dominance; and (3) equal influence over monetary policy by both countries. For exact definitions, let the monetary shocks in our earlier estimates (the baseline) be $\varepsilon_{t,GER}^m$ and $\varepsilon_{t,FR}^m$, and the common monetary shocks in the simulations be ε_t^m. The three policies under investigation will then be: (1) $\varepsilon_t^m = \varepsilon_{t,GER}^m$; (2) $\varepsilon_t^m = \varepsilon_{t,FR}^m$; and (3) $\varepsilon_t^m = (\varepsilon_{t,FR}^m + \varepsilon_{t,GER}^m)/2$. In example (1), German dominance, the only change in Germany is $\varepsilon_t^{m^*}=0$ and the focus naturally turns on France; and in example (2), French dominance, attention similarly centers on Germany.

Figure 4 indicates that German dominance over French monetary policy ($\varepsilon_t^m = \varepsilon_{t,GER}^m$) would have raised the level of French output in the post-1980 period, mostly by preventing the sharp 1980/81 recession. German dominance would have also avoided much of the French inflation in 1977-83, while causing inflation to be higher in the later part of the study period. Overall, German dominance would have substantially reduced the variability of both output growth and inflation in France. Under German dominance, however, France would have experienced higher (but less variable) deficits in the current account. These important effects of German dominance on French macroeconomic performance must be understood as the combined effect of two forces: first, the much smaller size of the German money supply shocks than the French ones; second, the significant contribution of French money supply shocks to output, inflation and the current account at home. The elimination of the $\varepsilon_t^{m^*}$ shocks does not influence the results much, except possibly in connection with the interest rate differentials (i-i*) as such.

Some welfare implications may be drawn if we make some assumptions about French policy preferences. Table 4 shows the magnitudes of the changes in the principal macroeconomic variables in the country. As the table indicates, only a marked French emphasis on current account balance relative to both output and inflation could lead the country not to prefer the results with German dominance. However, this pattern of preferences does not seem plausible. Apart from the

evidence of strong French concern with output, the switch to the policy of the "franc fort" in 1985-86 belies any possible idea that inflation matters little in French eyes.

This may raise a separate question: how do we explain the benefits to France from a different country's policy choices? The possibility to which we accord most credence is adherence to a false model in France. Our interpretation of the results is that the monetary ease of the seventies (which had been merely attenuated under Barre in 1976-81 but reinforced in the early Mitterrand years 1981-83) was simply a policy mistake. The country would have been better off if the shift to a German-type policy of a "franc fort" had come about earlier.

The corresponding analysis of French dominance over German monetary policy is displayed in Figure 5. Given such dominance, Germany would have experienced a virtually unaltered output and inflation history and some increase in current account surpluses. Once again, Table 4 displays the relevant magnitudes. The mildness of the changes, despite the much larger monetary shocks in Germany, clearly stems from the aforementioned moderation of the *influence* of money supply shocks in this country. But moderate as they may be, it could be argued that the effects of French dominance would nevertheless have been unfavorable in German eyes. The reason essentially lies in the added current account surpluses. Admittedly, Germany's record of large current account surpluses during much of the study period created no obvious dissatisfaction, while the few incidents of current account deficits aroused concern. Yet, given the high German current account surpluses during the period, the substantial additions to these surpluses that we find under French dominance could hardly be viewed as an advantage. On these grounds, we lean towards the view of some German losses in case of French monetary control. But we agree that our results imply relatively small welfare effects in Germany.

Table 4 also summarizes the evidence in the probably more realistic case of a joint monetary policy. With equal French and German influence on policy, the results for Germany are basically unaltered. Interestingly, for France the outcome of a joint monetary policy seems no worse, if not slightly better, than with Germany acting alone. There is somewhat less output growth, but also less inflation. Thus, in case of a French preoccupation with inflation, France would also find joint policy superior to German dominance.[10] The most important

[10] The surprising presence of lower French inflation if France has as big a part in decision-making as Germany owes a lot to the fact that, although more inflationary on the whole,

general conclusion with regard to France, however, is that German participation in decision-making always improves matters. We can show that this result still holds if we estimate our model with French inflation following an I(1) instead of an I(0) process.[11]

The issue of monetary integration requires us to turn our attention to the interest rate differentials $i - i^*$ in Figures 4 and 5. Any tendency of a uniform monetary policy to promote monetary integration would show up in our study in a narrowing of the level or the variance of the nominal interest rate differentials or both. Analyzing the results in this light, we find a narrowing of the variance of these differentials in all instances of a common monetary policy, regardless of the mix of French and German influence. Historically, the interest rate differential displayed a standard deviation of 1.6 percent per year. This variability is reduced by 40 percent under German dominance, but only by 17 percent under French dominance. The scenario of German dominance therefore is conductive to greater monetary integration than the opposite case.

6. Conclusions

We began with the common idea that the welfare implications of a loss of monetary independence in a monetary union depend heavily on the news in the environment. However, we then deviated from many authors by observing that these implications cannot be inferred, or even vaguely approximated, from the dissimilarities between shocks and responses to shocks in different countries. Instead, we proposed examining the impact of a common monetary policy across the countries in our study, that is, France and Germany. Since these two nations are strongly interdependent through trade in all areas -- commodities, services, capital goods and securities -- we adopted a structural VAR model incorporating the current account, the real exchange rate and interest rate differentials.

The outcomes of our simulations of a common monetary policy clearly do not relate to a full-blown monetary union. But they do pertain to one important aspect of such a union -- the one aspect, in our opinion, that the rest of the literature also tries to cope with in any significant way in analyzing shocks and

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French monetary policy was less inflationary than the German one -- at least, within the domestic context -- toward the end of the eighties (see Figure 4).

[11] As regards Table 4, the revised numbers are 0.16, -0.18 and -0.89 instead of 0.22, -0.20 and -1.10 (German dominance) and 0.13, -0.68 and -0.93 instead of 0.17, -0.82 and -1.03 (joint policy). All our conclusions are otherwise unaffected by this change in the specification.

responses to shocks. Furthermore, we find that common monetary policies do tend to promote monetary integration by bringing interest rates closer together.

Our most important conclusion implies that France would not suffer but would even gain from German participation in monetary-policy-making, while Germany would lose from similar French participation in the decision process. An even fifty-fifty split in monetary influence rather than full dominance on one side or the other does not greatly affect the general outlook.

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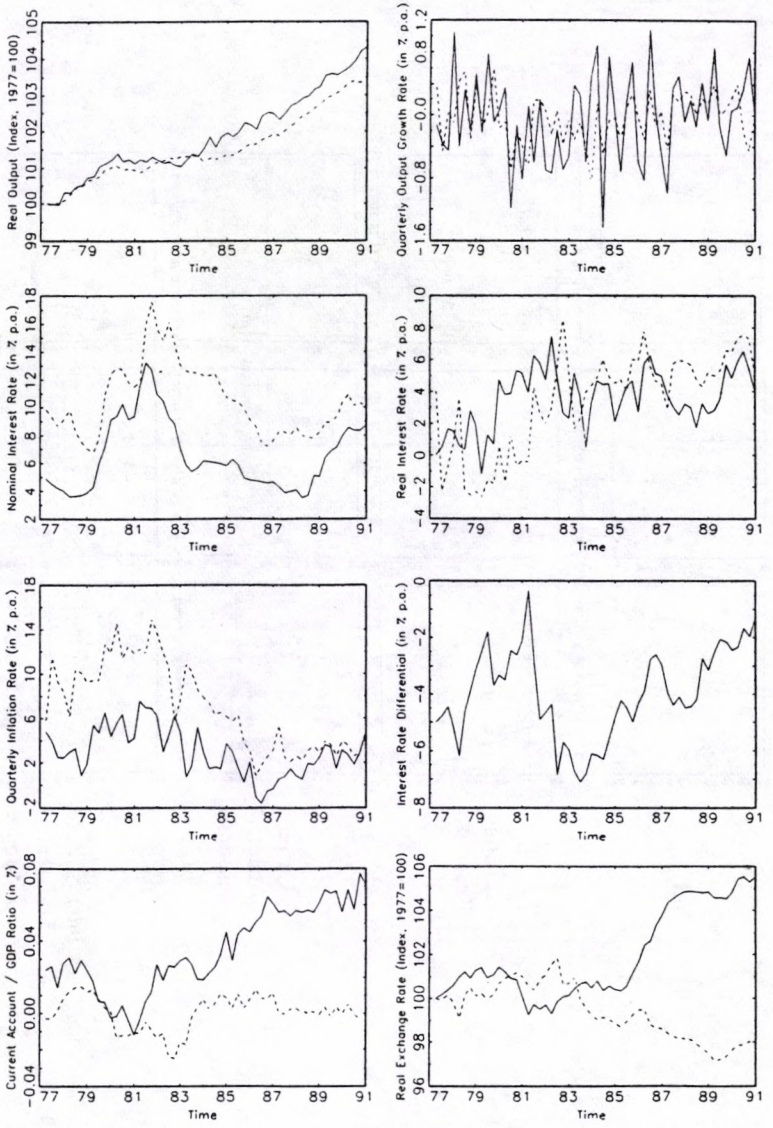
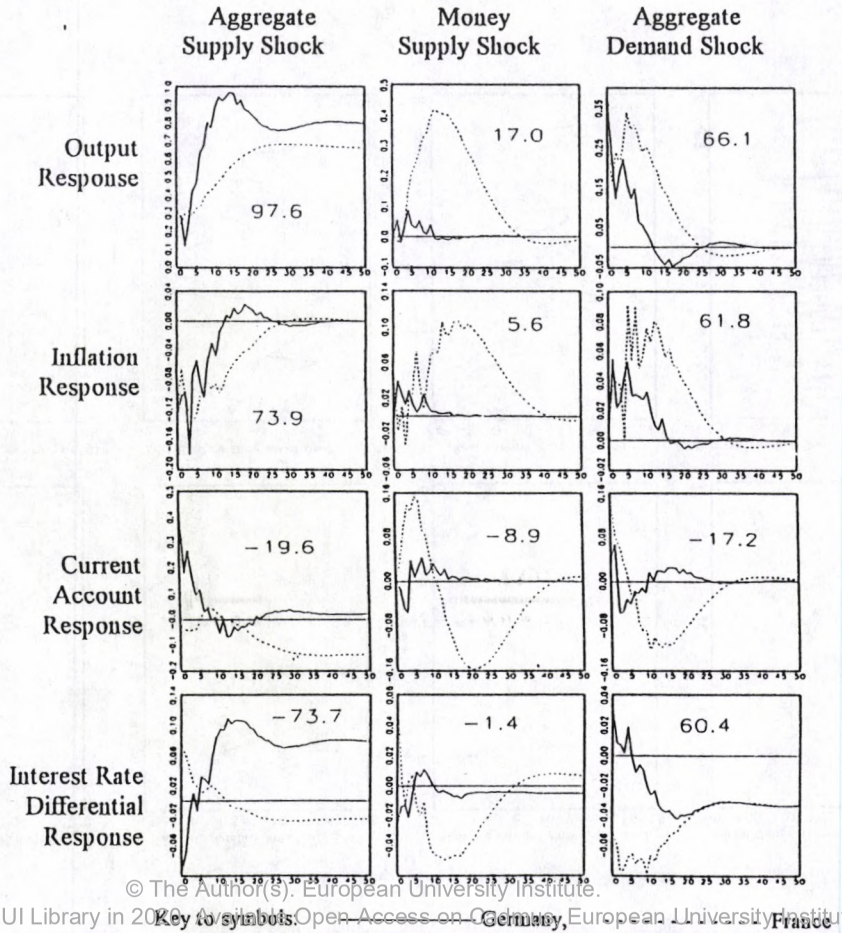
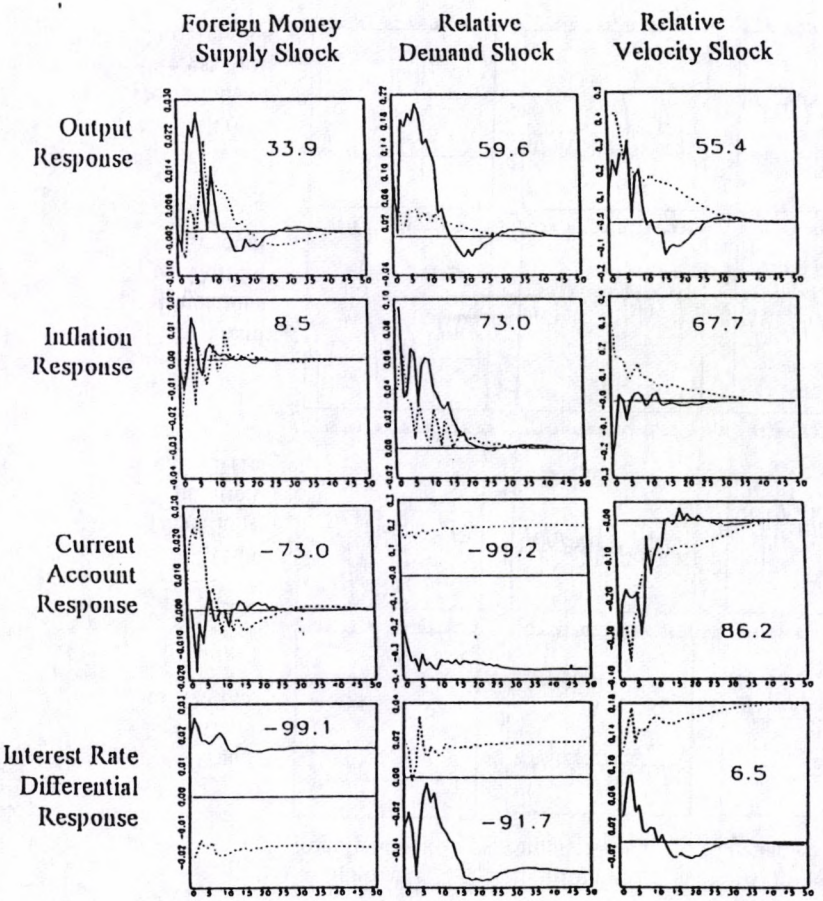
Figure 1.
Major Macroeconomic Indicators in Germany and France, Quarterly Data, 1977.I-1990.IV



Key to symbols: _____ **Germany,** - - - - - - - - - - **France**

Figure 2: Impulse Response Functions for Germany and France, Quarterly Data, 1977.I-1990.IV





Key to symbols: ——— Germany, - - - - - - - - - - - - France

Note: The numbers indicate the correlations between the impulse responses

Figure 3: Decompositions of Output, Inflation, the Current Account and Interest Rate Differentials into Shocks, Germany and France, Quarterly Data, 1977.I-1990.IV

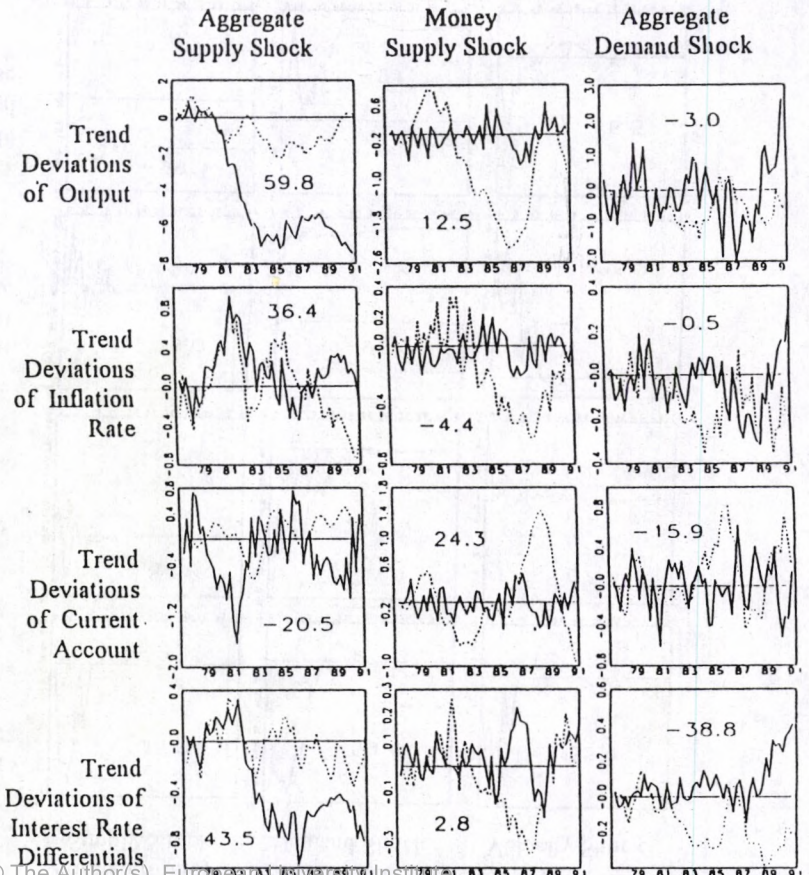
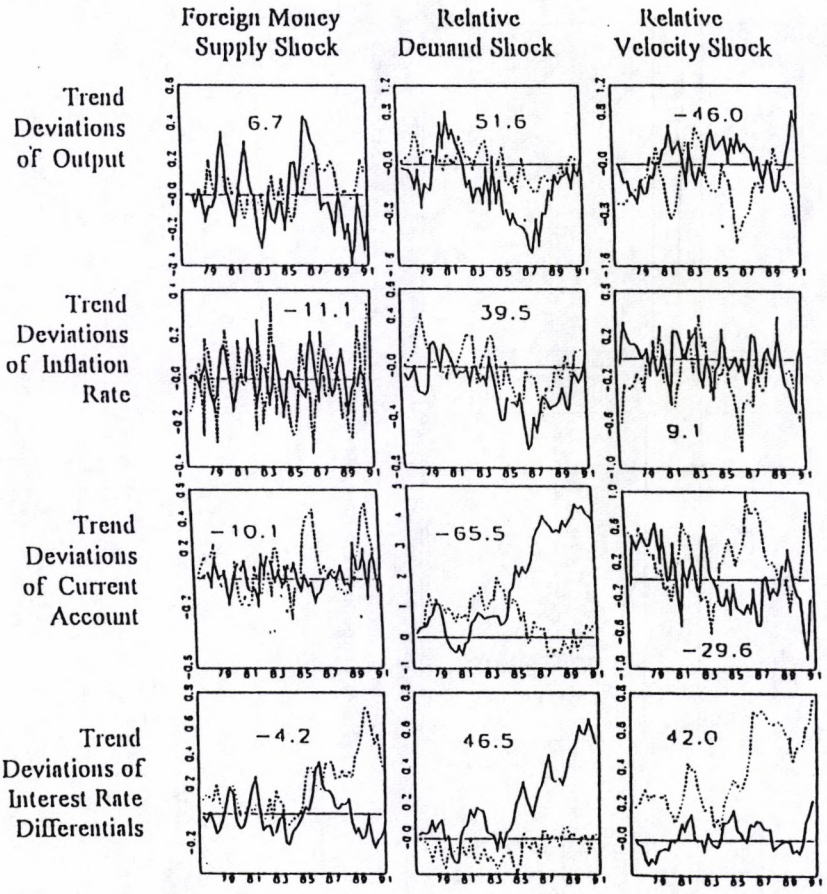


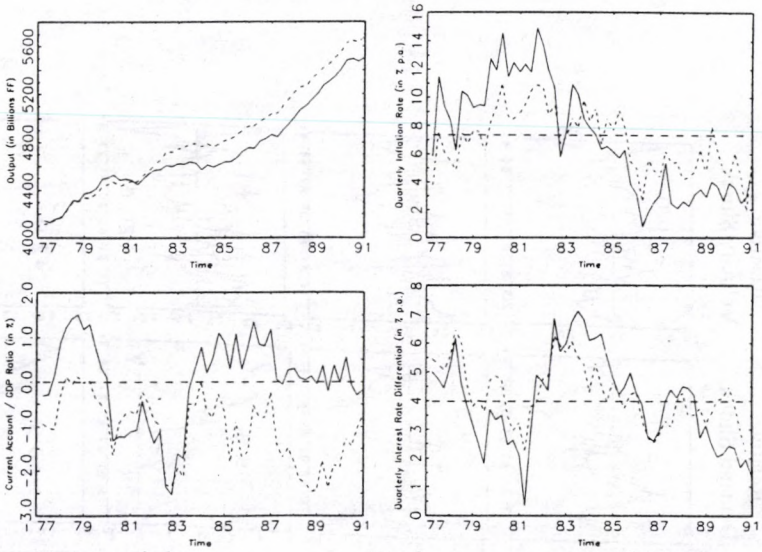
Figure 3: Decompositions of Output, Inflation, the Current Account and Interest Rate Differentials,
Germany and France, Quarterly Data, 1977.I-1990.IV



Key to symbols: Germany, ---------- France

Note: The numbers indicate the correlations between the shock components

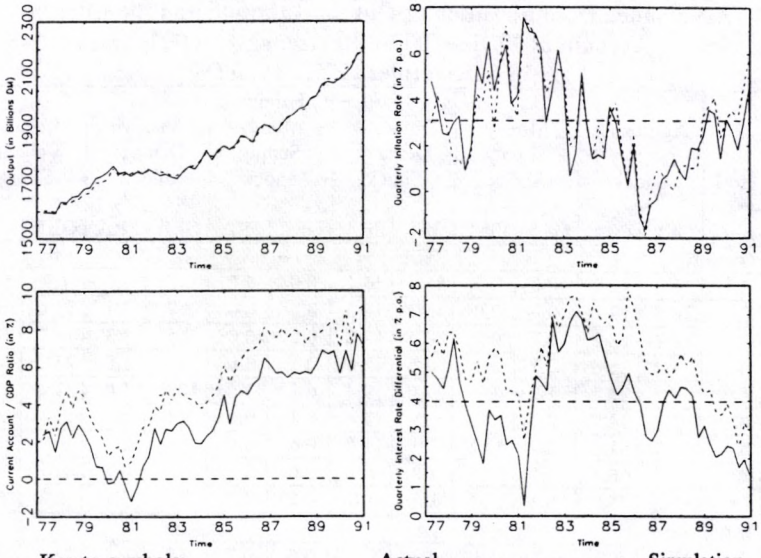
Figure 4: Actual and Counterfactual Economic Variables under German Dominance in Monetary Policymaking, French Quarterly Data, 1977.I-1990.IV



Key to symbols: _____ Actual, - - - - - - - - - - Simulation

Note: Output is in constant 1985 francs

Figure 5: Actual and Counterfactual Economic Variables under French Dominance in Monetary Policymaking, German Quarterly Data, 1977.I-1990.IV



Key to symbols: _____ Actual, - - - - - - - - - - - - Simulation

Note: Output is in constant 1985 marks

Table 1.
Variance Decomposition of Output, Inflation and the Current Account at Various Time Horizons, Quarterly Data (in %, Sample: 1977.I-1990.IV)

Hori-	Aggregate Supply Shock		Money Supply Shock		Domestic Demand Shock		Foreign Money Supply Shock		Relative Demand Shock		Relative Velocity Shock	
zon	GER	FRA	GER	FRA	GER	FRA	GER	FRA	GER	FRA	GER	FRA
Output												
1	36.8	15.9	0.0	0.0	55.5	26.4	0.0	0.0	4.7	0.8	2.9	56.9
2	38.5	19.2	0.7	0.0	43.2	18.0	0.0	0.0	2.7	2.1	15.0	60.7
3	34.2	22.2	0.7	0.1	38.4	17.8	0.0	0.0	8.5	1.3	18.3	58.6
4	33.4	25.6	0.7	0.1	32.5	17.6	0.1	0.0	10.1	1.0	23.2	55.7
5	39.8	27.1	1.2	1.7	27.0	19.4	0.1	0.0	10.5	1.0	21.4	50.8
10	72.2	34.7	0.5	13.5	9.5	22.4	0.1	0.0	7.1	0.6	10.7	28.7
20	90.7	51.0	0.2	23.1	3.0	11.9	0.0	0.0	2.4	0.3	3.7	13.7
30	93.7	66.3	0.1	17.0	2.0	7.5	0.0	0.0	1.6	0.2	2.6	9.0
40	95.3	75.0	0.1	12.6	1.5	5.6	0.0	0.0	1.2	0.1	1.9	6.7
Inflation												
1	17.7	8.9	0.0	1.1	0.1	0.1	0.0	0.7	9.2	0.2	73.0	89.0
2	20.6	9.2	1.2	1.0	2.4	0.8	0.1	0.6	13.7	2.1	62.1	86.3
3	25.6	12.2	1.5	0.9	2.5	1.3	0.1	0.5	13.3	3.3	56.9	81.7
4	39.2	16.0	1.3	1.2	2.4	1.6	0.2	0.5	11.4	3.2	45.5	77.6
5	38.2	20.0	1.6	1.3	3.1	1.4	0.2	0.5	12.6	3.1	44.4	73.7
10	40.5	24.3	1.7	2.8	5.0	6.5	0.2	0.4	16.2	2.5	36.4	63.5
20	39.7	23.4	1.6	14.9	5.4	10.5	0.2	0.3	17.7	1.9	35.4	49.0
30	39.5	21.1	1.6	21.9	5.4	10.1	0.2	0.2	17.5	1.8	35.7	45.0
40	39.6	20.9	1.6	22.5	5.4	10.0	0.2	0.2	17.5	1.7	35.7	44.6
Current Account / GDP Ratio												
1	48.7	0.3	0.0	0.0	0.5	12.8	0.0	0.0	8.2	24.5	42.6	62.4
2	40.1	0.7	0.0	0.5	1.2	10.3	0.0	0.1	20.0	22.8	38.6	65.6
3	37.7	0.9	0.3	2.7	1.3	8.5	0.0	0.2	29.1	22.7	31.5	64.9
4	33.6	0.9	0.6	5.1	1.4	6.1	0.0	0.2	34.7	21.0	29.6	66.7
5	28.6	1.0	0.6	6.7	1.2	5.2	0.0	0.3	41.4	20.8	28.0	65.9
10	17.5	1.2	0.5	10.5	0.9	5.6	0.0	0.2	54.9	28.1	26.1	54.3
20	11.5	1.4	0.4	12.8	0.7	10.6	0.0	0.2	70.6	37.7	16.9	37.3
30	8.3	5.7	0.3	17.0	0.5	8.4	0.0	0.1	78.8	41.5	12.0	27.3
40	6.5	10.9	0.2	14.5	0.4	6.7	0.0	0.1	83.7	45.9	9.2	21.9

Table 2.
Cross-country Correlations of Structural Shocks
(in %, Sample: 1977.I-1990.IV)

German / French	Aggregate Supply Shock	Money Supply Shock	Domestic Demand Shock	Foreign Money Supply Shock	Relative Demand Shock	Relative Velocity Shock
Aggregate Supply Shock	31.8	-21.4	1.8	-28.0	15.3	14.4
Money Supply Shock	23.7	-25.3	42.7	34.7	7.8	-3.5
Domestic Demand Shock	11.4	24.6	-13.4	35.9	13.4	28.3
Foreign Money Supply Shock	-19.1	-11.2	0.4	18.0	-15.8	-7.1
Relative Demand Shock	20.1	-0.4	-4.3	-39.2	-18.4	-8.8
Relative Velocity Shock	-0.7	1.1	-5.4	-21.0	38.9	-19.6

Table 3.
Cross-country Correlations of Shock Components of Output, Inflation and Current Account / GDP Ratio (in %, Sample: 1977.I-1990.IV)

German / French	Aggregate Supply Shock	Money Supply Shock	Domestic Demand Shock	Foreign Money Supply Shock	Relative Demand Shock	Relative Velocity Shock
Output						
Aggregate Supply Shock	59.8	62.3	51.7	-5.9	46.0	-0.9
Money Supply Shock	1.5	12.5	-23.2	-30.9	14.0	17.4
Domestic Demand Shock	30.2	20.2	-3.0	3.2	27.5	12.5
Foreign Money Supply Shock	-23.7	-30.5	54.3	6.7	-5.2	-36.8
Relative Demand Shock	43.7	80.8	2.4	-21.0	51.6	17.4
Relative Velocity Shock	-48.1	-36.4	2.7	13.3	-30.2	-46.0
Inflation						
Aggregate Supply Shock	36.4	44.4	13.9	7.1	12.9	25.3
Money Supply Shock	9.3	-4.4	-37.0	-11.9	-1.8	17.8
Domestic Demand Shock	-2.8	27.4	-0.5	6.7	24.0	0.6
Foreign Money Supply Shock	13.2	-12.6	-1.8	-11.1	1.7	-4.4
Relative Demand Shock	5.2	67.3	30.1	19.0	39.5	33.4
Relative Velocity Shock	13.4	8.4	21.8	-18.1	7.9	9.1
Current Account/GDP						
Aggregate Supply Shock	-20.5	-14.8	34.6	30.1	16.6	18.3
Money Supply Shock	-18.8	-24.3	23.0	17.0	17.0	29.3
Domestic Demand Shock	-16.0	22.5	-15.9	-24.0	1.7	1.0
Foreign Money Supply Shock	2.6	-5.2	-3.5	-10.1	-11.4	-25.9
Relative Demand Shock	44.6	38.0	29.1	29.1	-65.5	20.1
RelativeVelocity Shock	-29.6	8.8	-43.1	-15.0	22.4	-29.6

Table 4.
Changes in the Mean and Standard Deviation of Economic Performances under Different Policy Scenarios, Sample: 1977.I-1990.IV.

Policy Variable	France		Germany	
	German Dominance	Joint Policy	French Dominance	Joint Policy
	Means		Means	
Output Growth (avg. % p.a.)	0.22 (2.38)	0.17 (2.38)	0.07 (2.60)	0.03 (2.60)
Inflation (avg. % p.a.)	-0.20 (7.34)	-0.82 (7.34)	0.07 (3.11)	-0.08 (3.11)
Curr. Account / GDP (avg. %)	-1.10 (0.03)	-1.03 (0.03)	1.68 (3.50)	1.67 (3.50)
	Standard Deviations		Standard Deviations	
Output Growth (avg. % p.a.)	-0.46 (2.70)	-0.44 (2.70)	-0.11 (4.23)	-0.20 (4.23)
Inflation (avg. % p.a.)	-1.76 (3.92)	-1.61 (3.92)	-0.07 (2.16)	-0.12 (2.16)
Curr. Account / GDP (avg. %)	-0.33 (0.95)	-0.36 (0.95)	0.04 (2.31)	0.04 (2.31)

Key: The numbers in the table indicate the change of the means and standard deviations under the various policy scenarios relative to their historical values. The numbers in parenthesis indicate the historical values of the policy variables in terms of their mean and standard deviation.

Appendix

A1. Unit Root Properties of the Data

Our testing strategy critically depends on the relative order of integration of the data. This appendix will thus discuss the unit root properties of the data. Tables A1 and A2 display three types of unit root test statistics: (i) augmented Dickey-Fuller (1981) ADF 't-statistics' for both demeaned ($t^{\mu}(z)$) and detrended data ($t^{\tau}(z)$); (ii) Stock's (1991) 95% confidence intervals for the largest unit root (ρ), along with the estimate of the actual root of the series ($\hat{\rho}$), and (iii) three Phillips-Perron 't-statistics' ($Z(t_{\hat{\alpha}}$ $Z(t_{\alpha^*})$, and $Z(t_{\tilde{\alpha}})$). The main difference between the ADF and Phillips-Perron tests is that the ADF $t^{\tau}(z)$ and $t^{\mu}(z)$ tests adjust for autocorrelations in the first differences of the data parametrically by optionally including j lags of the differenced data as regressors:

$$\Delta z_t = \mu + (\alpha - 1) z_{t-1} + \gamma_i \sum_{i=1}^{j} \Delta z_{t-i} + u_t, \qquad t^{\mu}(z) \text{ for } H_0\text{: } \alpha=1, \qquad \text{(A1)}$$

$$\Delta z_t = \mu + (\alpha - 1) z_{t-1} + \beta t + \gamma_i \sum_{i=1}^{j} \Delta z_{t-i} + u_t, \qquad t^{\tau}(z) \text{ for } H_0\text{: } \alpha=1, \qquad \text{(A2)}$$

whilst the three Phillips-Perron tests:

$$\Delta z_t = (\hat{\alpha} - 1) z_{t-1} + \hat{u}_t, \qquad Z(t_{\hat{\alpha}}) \text{ for } H_0\text{: } \hat{\alpha}=1, \qquad \text{(A3)}$$

$$\Delta z_t = \mu^* + (\alpha^* - 1) z_{t-1} + u_t^*, \qquad Z(t_{\alpha^*}) \text{ for } H_0\text{: } \alpha^*=1, \qquad \text{(A4)}$$

$$\Delta z_t = \tilde{\mu} + (\tilde{\alpha} - 1) z_{t-1} + \tilde{\beta}(t - T/2) + \tilde{u}_t, \qquad Z(t_{\tilde{\alpha}}) \text{ for } H_0\text{: } \tilde{\alpha}=1, \qquad \text{(A5)}$$

are based on a nonparametric adjustment for this type of autocorrelation. The Phillips-Perron tests reported here are based on the Newey and West (1987) estimator, which yields a robust variance estimate in the presence of dependent and heterogeneously distributed data by prefiltering the residuals u_t from the regression:

$$\Delta z_t = \mu + \beta(t - T/2) + u_t, \qquad \text{(A6)}$$

(under the restrictions $\mu=0$ and $\beta=0$ for (A3), and $\beta=0$ for (A4)) with a triangular lag window with weights for lag i ($i=1,\ldots,j$) given by $\omega(i,j) = 1 - [i/(j+1)]$. The choice of the relevant test statistics amongst $Z(t_{\hat{\alpha}})$, $Z(t_{\alpha^*})$, and $Z(t_{\tilde{\alpha}})$ is made on the basis of the Phillips-Perron 't-tests'

$Z(t_{\mu^*})$, $Z(t_{\tilde{\mu}})$, and $Z(t_{\tilde{\beta}})$ concerning the significance of the deterministic drifts and trends in equations (A4) and (A5), respectively.

The specification of the degree of time differencing and drift or trend adjustment of the endogenous variables varies somewhat between Germany and France, as is documented in the last column of Tables A1 and A2. Since we focus on the long-run properties of the data, we chose the maximum sample period for which each time series was available in order to conduct our unit root analysis. Our results show that output (y_t) in both countries is integrated of order one with a drift, I(1)+d. Consumer price inflation (Δp_t) in Germany looks like an I(0) process with a trend according to both the Phillips-Perron and the Stock test. These test statistics are, however, only marginally significant for the French inflation process. For France we find stronger evidence of an I(1) inflation process. Galí (1992) was confronted with the same problem and chose inflation to be an I(0) process. Since we decided to estimate an identical model specification for both countries, we have followed Galí in treating inflation as I(0) in both countries, but for France we also report our main results with an I(1) specification.

Similar problems arise for nominal short-term interest rates (i_t). Nominal interest rates were found to be I(1) for France, and I(0)+d for Germany. It is therefore not surprising that interest rate differentials ($i_t - i_t^*$) were found to be I(1). Furthermore, given the properties of the consumer price data, real interest rates ($r_t = i_t - \Delta p_t$) turned out to be I(0) with a trend for Germany. In order to check for possible cointegration in France we examined whether the linear combination of French inflation rates and nominal interest rates was I(0). We found that French real interest rates are indeed best described by an I(0) process. Finally, the current account to GDP ratios (χ_t) and real effective exchange rates ($e_t + P_t^* - P_t$) turned out to be I(1) in both France and Germany.

A2. Confidence Bands for the Impulse Response Functions

Although it is standard to report point estimates, a meaningful interpretation of the dynamic responses of the endogenous variables to the various shocks is impossible unless standard errors are attached to the point estimates. There are two ways to compute standard errors for these statistics. One is the asymthotic criteria suggested by Lütkepohl (1991). The other is to construct standard errors numerically by using a Monte Carlo approach. Here we follow the second approach and compute the first and second moments of the statistics by drawing directly from the posterior distribution of the VAR coefficients.

To outline our Monte Carlo integration approach, we follow Galí 1992) and Canova and Di Nicoló (1995). Our random drawings are conditioned on both the posterior distribution of the VAR coefficients and our estimate of the just-identified matrix S. Suppose we write the VAR as:

$$y_t = (I \otimes x_t)\beta + \varepsilon_t \qquad \text{(A7)}$$

where $\otimes$ is the Kronecker delta, x_t is the vector of lagged y_{it} (i=1,2,...,m), β is a vector containing the stacked version of the A(L) and of the A_0 matrices and u_t is i.i.d. with distribution N(0,Σ). We denote the ordinary least-squares (OLS) estimates of β and Σ by b and Z. If we assume that the prior distribution of β is $f(\beta,\Sigma) \propto |\Sigma|^{-(n+1)/2}$, the posterior distribution of β, conditional on Σ, is normal with mean b and covariance matrix $\Sigma \otimes (x'x)^{-1}$ and the distribution of Σ^{-1} is Wishart$(TZ)^{-1}$,T), where T is the sample size. First and second moments of can be computed by drawing Q times from the above distribution for β and Σ, inverting the VAR, and conditional on the just-identified matrix S computing the average impulse responses and standard error bands by appropriately averaging over replications. In our simulations we chose Q=100, because additional replications did not lead to any visible changes in the computed significance bounds.

Table A1:
Unit-Root Test Statistics for Key Macroeconomic Variables in Germany

			Augmented Dickey-Fuller Tests, Detrended Data				Augmented Dickey-Fuller Tests, Demeaned Data				Phillips-Perron Tests			
Variable	Symbol	Period	$t^{\tau}(z)$	sig. level	$\hat{\rho}$	Stock's ρ intervals	$t^{\mu}(z)$	sig. level	$\hat{\rho}$	Stock's ρ intervals	$Z(t_{\hat{\alpha}})$	$Z(t_{\alpha^*})$	$Z(t_{\tilde{\alpha}})$	Decision
Output	y	64:1-90:4	-2.40	-	0.93	(- , -)	-1.07	-	0.99	(0.94,1.04)	5.81	-1.61	-2.32	I(1)+drift
	Δy		-4.18	(***)	0.10	(- , -)	-4.14	***	0.16	(- ,0.86)	-9.26(***)	-11.5***	-11.7(***)	
Inflation	Δp	62:1-90:4	-1.96	(-)	0.82	(- , -)	-1.89	-	0.83	(0.89,1.03)	-3.43(***)	-7.20(***)	-7.28***	I(0)+trend
Rate	Δ^2p		-5.47	(***)	-1.35	(- , -)	-5.49	***	-1.34	(- ,0.71)	-17.0(***)	-17.0(***)	-17.1(***)	
Nominal	i	62:1-90:4	-4.36	(***)	0.83	(- , -)	-4.24	***	0.84	(- ,0.86)	-0.77	-2.88**	-2.94	I(0)+drift
Int. Rate	Δi		-5.04	(***)	0.27	(- , -)	-5.07	(***)	0.27	(- ,0.76)	-7.90(***)	-7.91(***)	-7.91(***)	
Real Int.	i-Δp	62:1-90:4	-4.02	***	0.49	(- , -)	-3.47	(***)	0.60	(0.68,0.93)	-4.42(***)	-7.31(***)	-7.81***	I(0)+trend
Rate	Δ(i-Δp)		-4.99	(***)	-0.76	(- , -)	-5.01	(***)	-0.76	(- ,0.75)	-15.5(***)	-15.5(***)	-15.5(***)	
Interest	i-i*	72:1-90:4	-1.97	(-)	0.87	(- , -)	-2.38	-	0.86	(0.74,1.04)	-1.24	-2.61*	-2.33	I(1)
Rate Diff.	Δ(i-i*)		-5.91	(***)	-0.52	(- , -)	-5.62	***	-0.42	(- ,0.47)	-7.24(***)	-7.24***	-7.34(***)	
Current	χ	67:1-90:4	-2.11	(-)	0.87	(- , -)	-2.30	-	0.87	(0.81,1.03)	-0.89(***)	-2.53	-2.48	I(1)
Account	Δχ		-4.83	(***)	-0.23	(- , -)	-4.89	***	-0.24	(- ,0.74)	-14.7(***)	-14.7***	-14.8(***)	
Real Ex.	p-e-p*	77:1-90:4	-2.41	-	0.90	(- , -)	-0.59	(*)	0.99	(0.95,1.10)	1.66	-0.22	-1.42	I(1)
Rate	Δ(p-e-p*)		-2.96	(-)	0.39	(- , -)	-2.91	**	0.41	(0.44,1.02)	-6.05***	-6.43(***)	-6.50(***)	

Table A1 continued

Key to Table: $t^{\tau}(z)$ in column 3 and $t^{\tau}(z)$ in column 7 are the augmented Dickey-Fuller tests for detrended data and demeaned data respectively. Their significance levels are taken from Table 8.5.2. of Fuller (1976), p. 373. A rejection of the null hypothesis of a unit root at the 1% significance level is marked with ***, at the 5% level with **, and at the 10% level with *. Significance levels in brackets indicate that the corresponding coefficient of the deterministic trend in column 3 (drift in column 7) was not significantly different from zero at the 5% level. Stock's (1991) 95% confidence intervals for the largest unit root ρ were calculated from the ADF statistics using Stock's Tables A1 and A2 and the procedure described in Appendix B of his paper. In addition to the confidence belts for ρ the estimated roots $\hat{\rho}$ are displayed. The three Phillips-Perron unit root tests reported are discussed in Perron (1988). $Z(t_{\hat{\alpha}})$ tests the null hypothesis of a unit root against an AR(1) regression without deterministic drift or trend, while $Z(t_{\alpha^*})$ includes a drift and $Z(t_{\tilde{\alpha}})$ both a drift and trend. Estimates were obtained using the Newey-West estimator. A rejection of the null hypothesis of a unit root at the 1% significance level is marked with ***, at the 5% level with **, and at the 10% level with *. Significance levels in brackets indicate that the Phillips-Perron test $Z(t_{\mu^*})$ for a drift and $Z(t_{\tilde{\beta}})$ for a trend were not significant at the 5% level. Critical values for the Phillips-Perron tests are taken from Tabele 8.5.2. in Fuller (1976), p. 371, and Tables I to III in Dickey and Fuller (1981), p. 1062. All ADF statistics are based on regressions including six lagged differences of the variable, and the Newey-West estimators for the Phillips-Perron used a lag-window of order six.

Table A2:
Unit-Root Test Statistics for Key Macroeconomic Variables in France

			Augmented Dickey-Fuller Tests, Detrended Data				Augmented Dickey-Fuller Tests, Demeaned Data				Phillips-Perron Tests			
Variable	Symbol / Period		$t^{\tau}(z)$	sig. level	$\hat{\rho}$	Stock's ρ intervals	$t^{\mu}(z)$	sig. level	$\hat{\rho}$	Stock's ρ intervals	$Z(t_{\hat{\alpha}})$	$Z(t_{\alpha^*})$	$Z(t_{\tilde{\alpha}})$	Decision
Output	y	72:1-90:4	-2.42	-	0.92	(- , -)	-1.32	-	0.99	(0.88,1.06)	5.81	-1.56	-2.50	I(1)+drift
	Δy		-3.04	(-)	0.42	(- , -)	-3.02	**	0.46	(0.58,1.01)	-4.76(***)	-7.11***	-7.24(***)	
Inflation	Δp	62:1-90:4	-1.36	(-)	0.92	(- , -)	-1.46	-	0.91	(0.92,1.04)	-1.42	-2.98**	-3.02	I(0)+drift
Rate	Δ^2p		-6.28	(***)	-1.04	(- , -)	-6.30	***	-1.00	(- , -)	-16.1(***)	-16.2(***)	-16.2(***)	or I(1)
Nominal	i	72:1-90:4	-2.50		0.88	(- , -)	-2.60	*	0.88	(0.67,1.02)	-0.30	-2.49	-2.42	I(1)
Int. Rate	Δi		-4.92	(***)	0.07	(- , -)	-4.89	(***)	0.08	(- ,0.67)	-5.45(***)	-5.45(***)	-5.48(***)	
Real Int.	i-Δp	72:1-90:4	-2.95		0.56	(- , -)	-0.74		0.93	(0.94,1.07)	-1.79(***)	-2.63(*)	-5.80***	I(0)+trend
Rate	Δ(i-Δp)		-5.74	(***)	-1.71	(- , -)	-5.67	(***)	-1.61	(- ,0.49)	-14.2(***)	-14.4(***)	-14.5(***)	
Interest	i-i*	72:1-90:4	-1.97	(-)	0.87	(- , -)	-2.38	-	0.86	(0.74,1.04)	-1.24	-2.61*	-2.33	I(1)
Rate Diff.	Δ(i-i*)		-5.91	(***)	-0.52	(- , -)	-5.62	***	-0.42	(- ,0.47)	-7.24(***)	-7.24***	-7.34(***)	
Current	χ	75:1-90:4	-2.97	(-)	0.70	(- , -)	-2.95	*	0.71	(0.53,1.02)	-3.00(***)	-3.00*	-3.00	I(1)
Account	Δχ		-5.98	(***)	-0.52	(- , -)	-6.05	***	-0.52	(- , -)	-8.16***	-8.16***	-8.15(***)	
Real Ex.	p-e-p*	77:1-90:4	-1.86	-	0.86	(- , -)	-0.72	(-)	0.97	(0.92,1.09)	-0.80	-0.96	-2.17	I(1)
Rate	Δ(p-e-p*)		-2.87	(-)	0.19	(- , -)	-2.90	**	0.19	(0.44,1.02)	-7.00***	-7.07(***)	-7.08(***)	

Key to Table: See Table A1

Figure A1: Impulse Response and Standard Error Bands for Germany, Quarterly Data, 1977.I-1990.IV

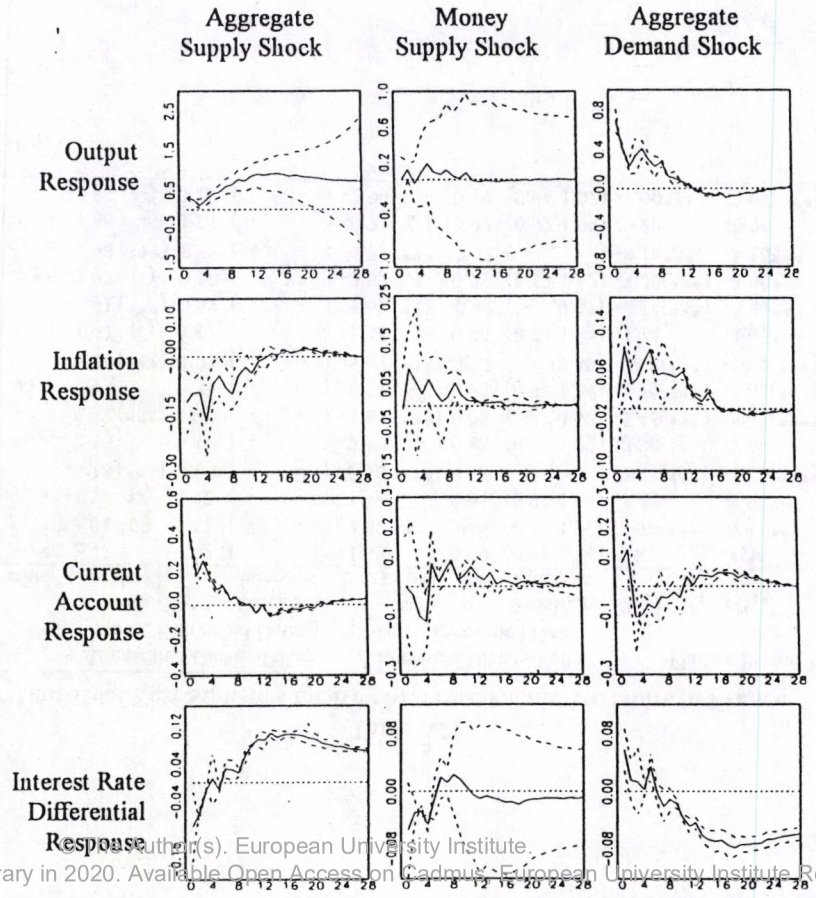


Figure A1: Impulse Response and Standard Error Bands for Germany, Quarterly Data, 1977.I-1990.IV

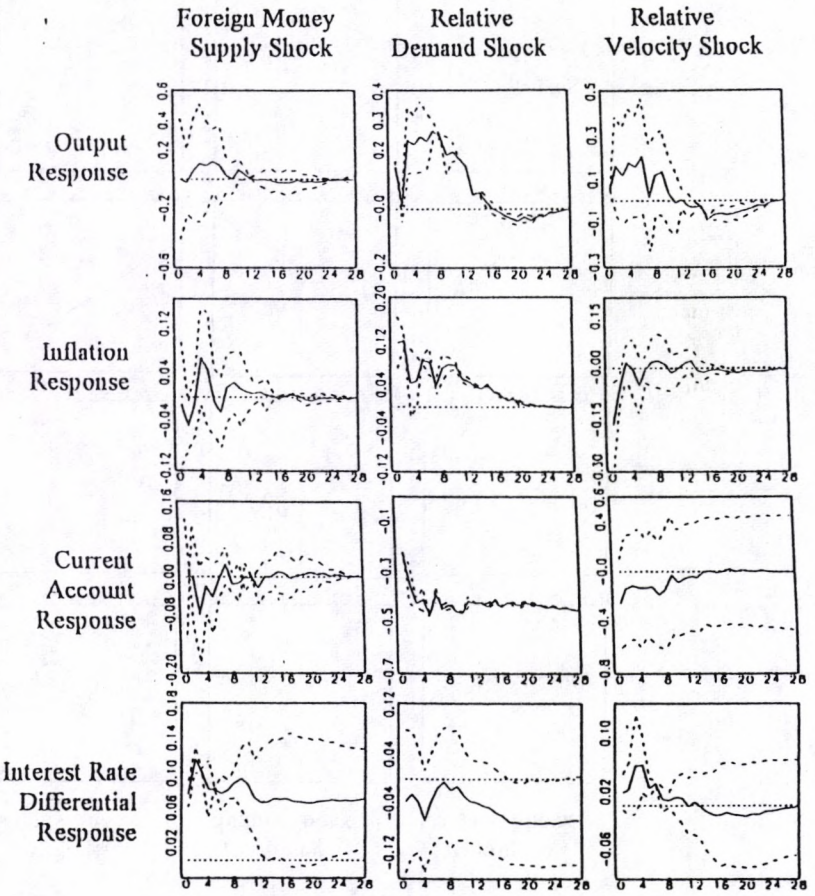


Figure A2: Impulse Response and Standard Error Bands for France, Quarterly Data, 1977.I-1990.IV

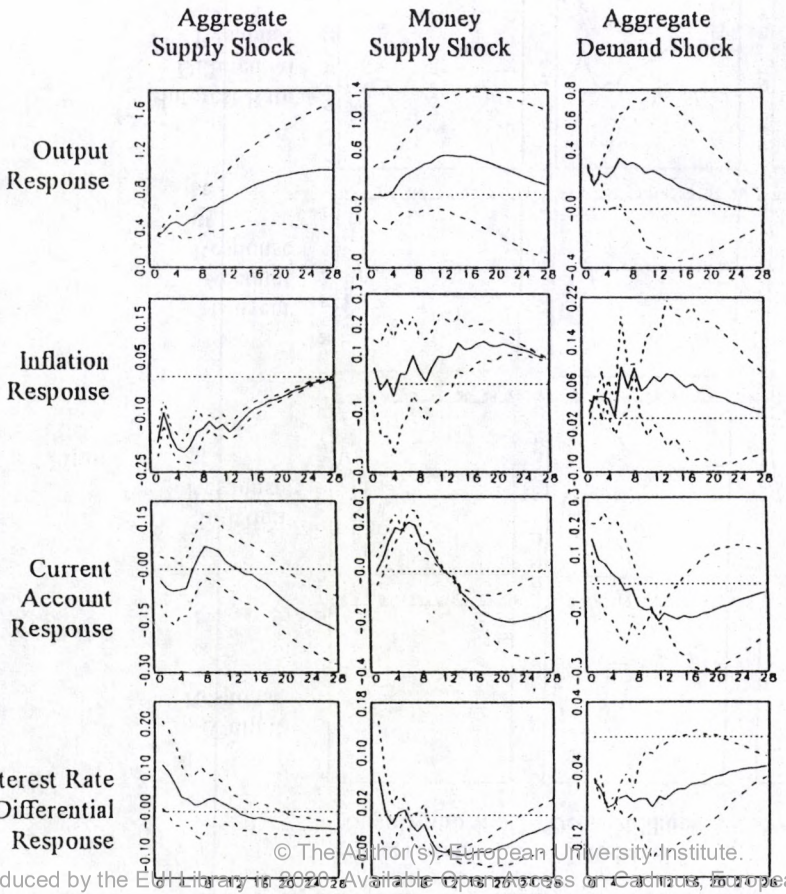
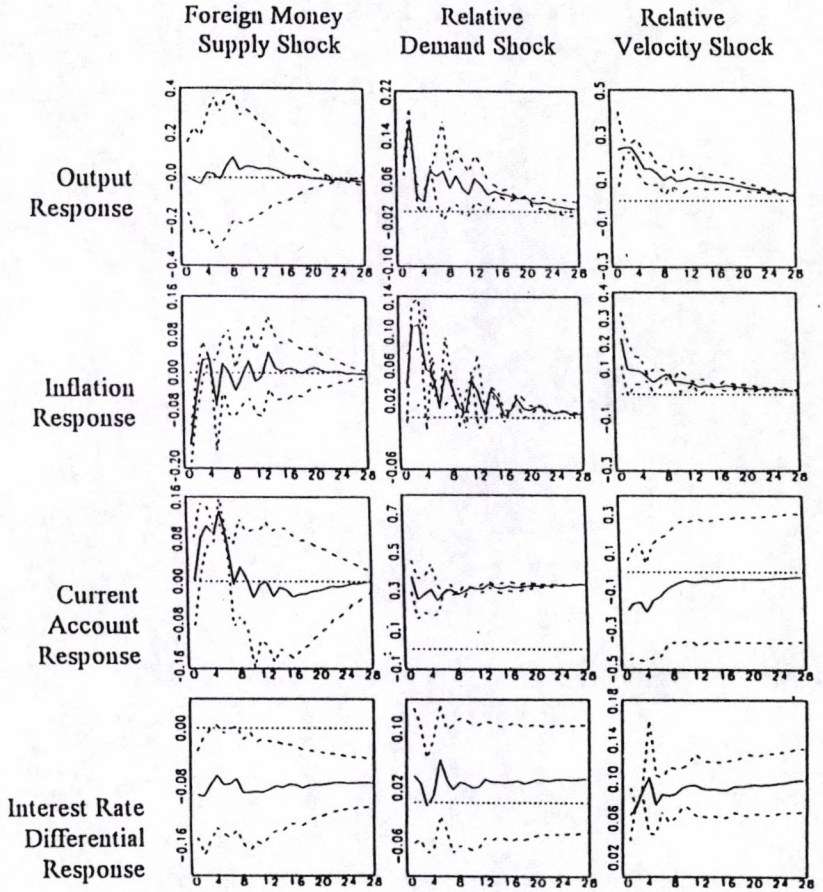


Figure A2: Impulse Response and Standard Error Bands for France, Quarterly Data, 1977.I-1990.IV



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